EPL 2014 vol.108 N5

Conduction of spin currents through insulating antiferromagnetic oxides

Hahn C., De Loubens G., Naletov V., Ben Youssef J., Klein O., Viret M.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

Copyright © EPLA, 2014. Damping processes, associated to magnetization dynamics, allow to generate spin currents from precessing ferromagnets. These can be transmitted into adjacent conducting layers through an interface exchange interaction with conduction electrons. It is in principle also possible to inject angular momentum into insulators but the relevant physical mechanisms are not yet identified. In order to test some ideas concerning pure spin transport through insulating oxides, the present paper reports on the behaviour of two materials with very different properties: NiO is an antiferromagnet whereas SiO2 is a non-magnetic light element insulator. While a sizeable flow of angular momentum is found to be able to propagate through nickel oxide, a SiO2 layer as thin as 2 nm completely blocks this transfer. This underlines some essential features required to conduct a spin current, including the presence of either magnetic order through which magnons can propagate, or compounds with large spin-orbit interactions where phonons can carry angular momentum.

http://dx.doi.org/10.1209/0295-5075/108/57005